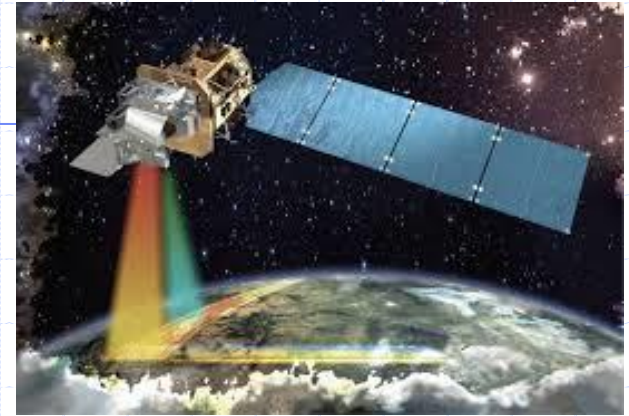# Google Earth Engine Evapotranspiration Flux --- EEFlux and Global ET Mapping and Use of Satellite Platforms for ET

**Ayse Kilic,** University of Nebraska-Lincoln

International Workshop on Evapotranspiration Mapping– Sept. 15, 2015

WHAT IS EEFlux?

- **E**arth **E**ngine **E**vapotranspiration **Flux**

- Began in 2012

- Uses the METRIC ET process (thermally-driven energy balance) as foundation

- Operates on the Google Earth Engine and Computational Cloud

- Automated operation and calibration

Google Earth Engine Evapotranspiration Flux

ETrF--Fraction of Reference ET
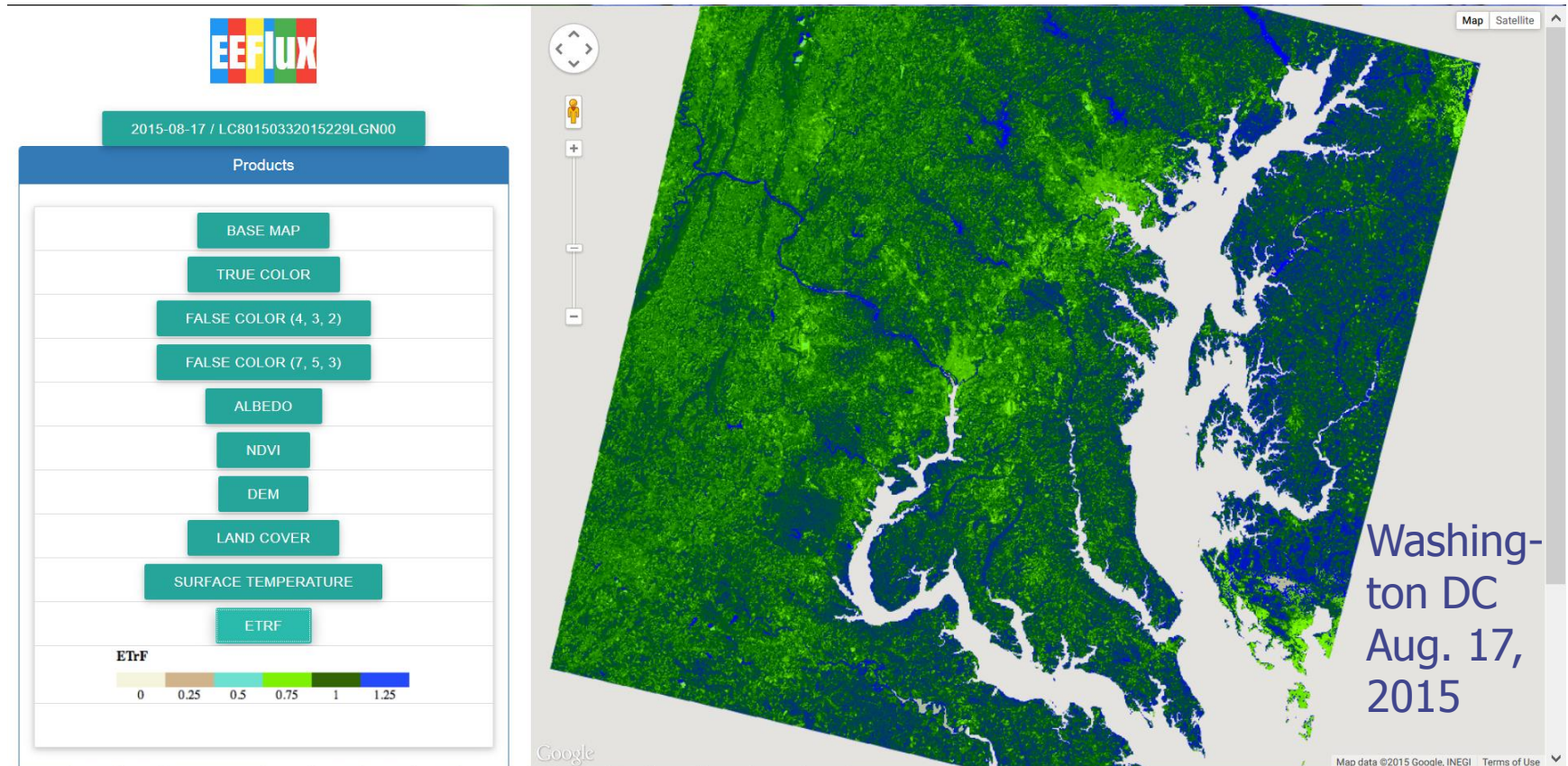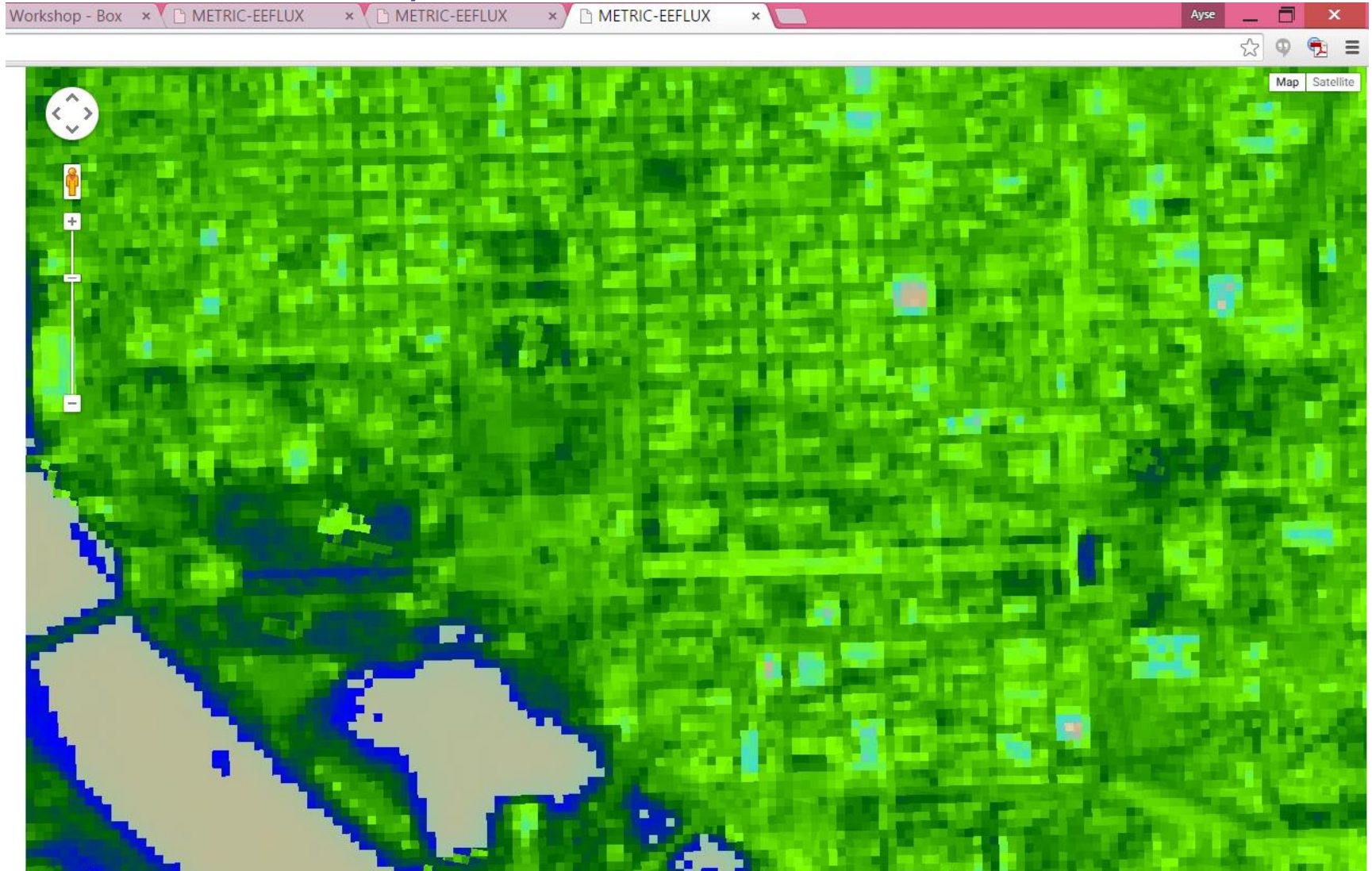

$$ET_rF = ET/ET_{ref}$$

ET_{ref} is reference ET- ASCE-Penman Monteith Alfalfa reference
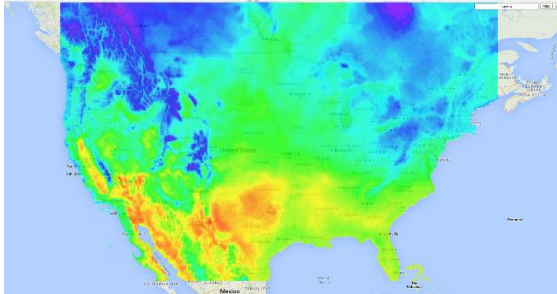
ETrF MAP- NATIONAL MALL, WASHINGTON, DC
August 17, 2015
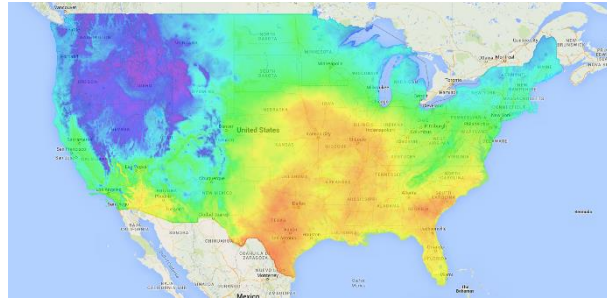*Currently runs with Landsat – 30 m resolution of ET*

Local and Global ET Mapping requires Supporting Resourses – Weather Data, Soils Data, Land-Use

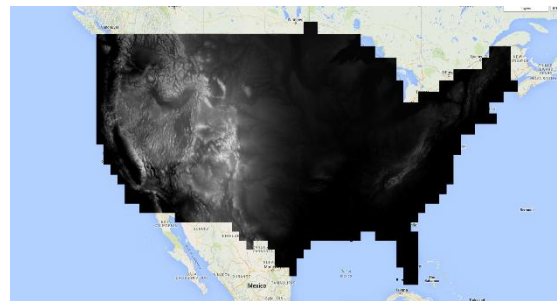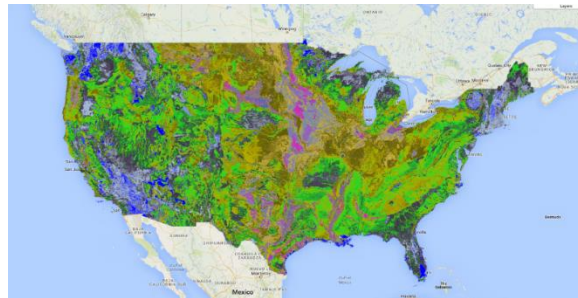NLDAS-Jan 1, 1979 - Current

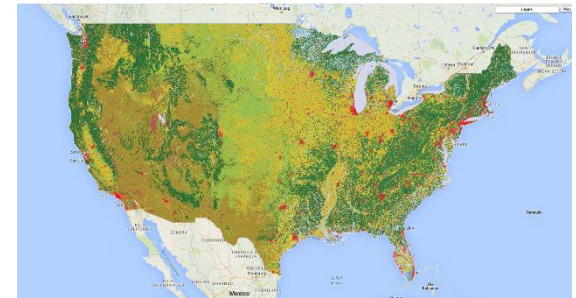GRIDMET-Jan 1, 1979 - Current
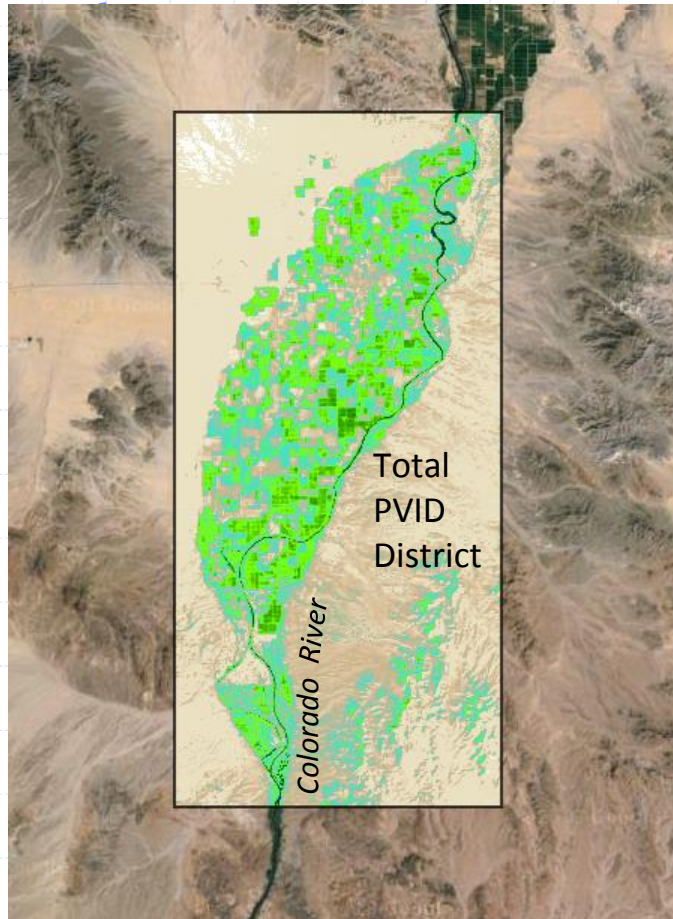

Landsat 5/7/8

DEM

Soil Data Layers

NLCD Landuse

These data products are loaded and are functional on Earth Engine

http://eeflux-level1.appspot.com

We can get field-scale ET from Satellites (Landsat)

Google Earth Engine Flux --- EEFlux
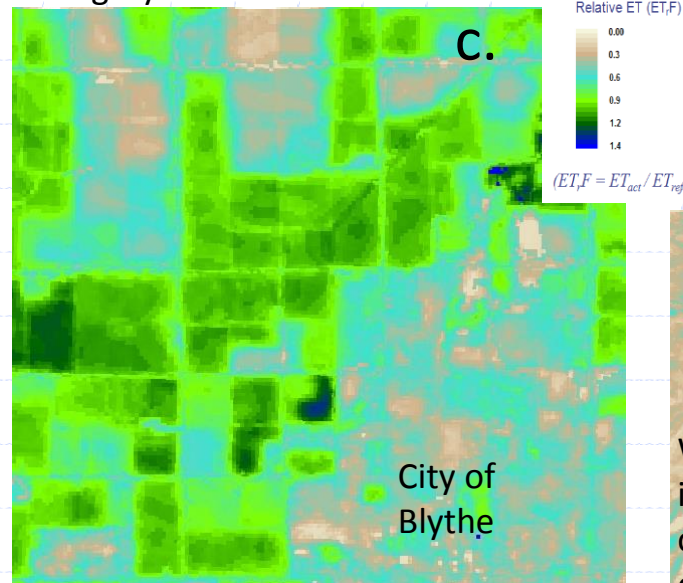

Total PVID District

Colorado River

Earth Engine Evapotranspiration Flux

Palo Verde Irrigation District

Blythe, California – Jan. – Dec. 2008

-- Landsat 5 imagery

Dec.

Relative ET (ET,F)

0.00
0.3
0.6
0.9
1.2
1.4

$(ET_rF = ET_{act} / ET_{ref})$

City of Blythe

Fallowed Fields

Irrigated Fields

Wetlands in south of District on Colorado River

Univ. Nebraska-Lincoln, Univ. Idaho, Desert Research Institute
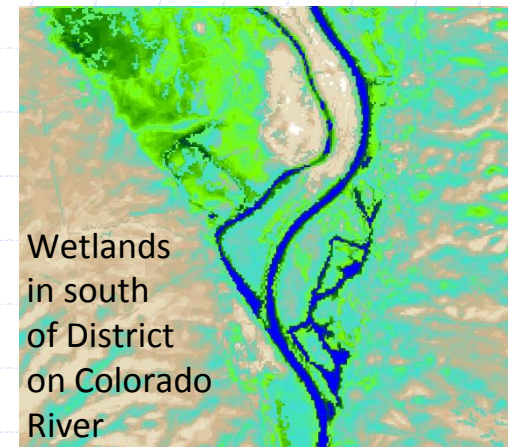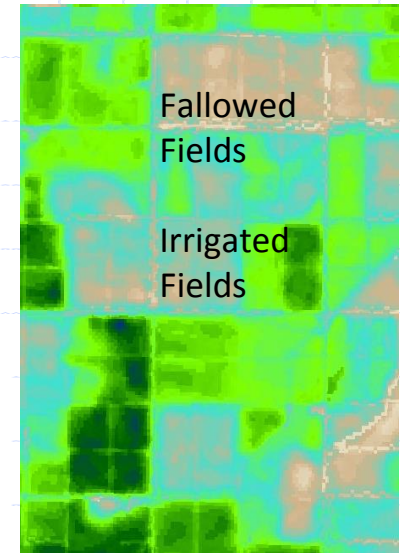
Computations are based on a complete surface energy balance *(METRIC)*

EEFlux -- IT IS RUNNING GLOBALLY

GLOBAL SOIL
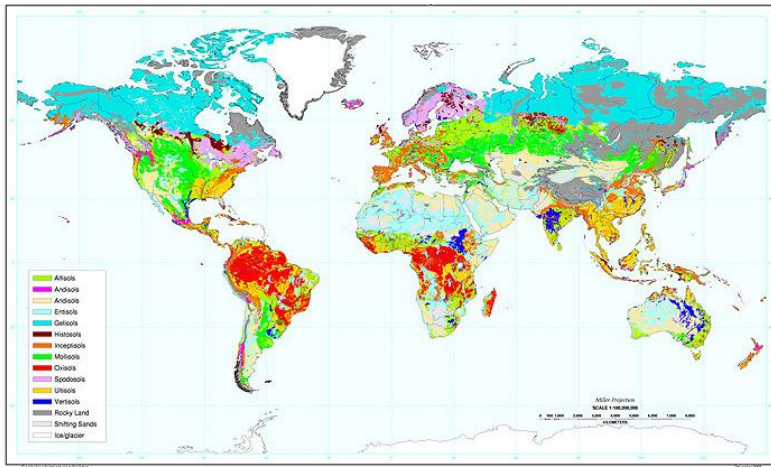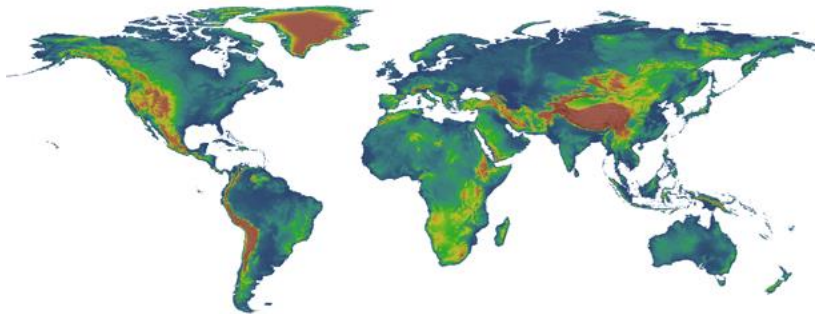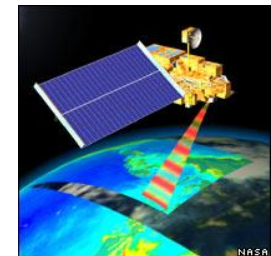
LANDUSE-ESA

DIGITAL ELEVATION DATABASE-SRTM

LANDSAT 5/7/8

MODIS

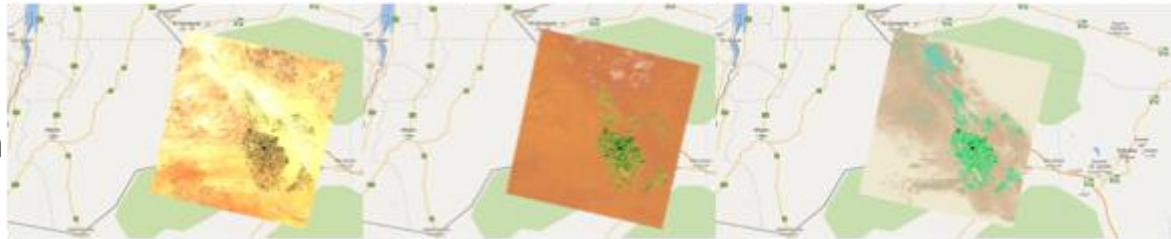These data products are loaded and are functional on Earth Engine

EEFlux Applications around the Globe

Imperial Valley, CA

Jordan

Chile

We are now running EEFlux over the globe in a number of Countries and Conditions.
Soon we will be providing time integration to monthly and growing season ET

Spatal Resolution

- ◆ There are a number of spatial resolutions
  - GOES -- 4 km to 12 km
  - MODIS – 1 km thermal
  - VIIRS – 400 m thermal
  - Landsat – 30 m short wave, 60-120 m thermal
- ◆ Best Spatial resolution depends on application
  - Global vs. Local?
  - Hydrology vs. water transfers/rights?
  - Accuracy
  - Revisit time ~ 1 / resolution

Approaches

- There are a number of Approaches and Satellites used for **Global Mapping**
  - EEFlux --- Landsat
  - Alexi – Goes/MODIS can be downscaled to Landsat
- **Local ET mapping** generally uses Landsat
  - field-scale ET is usually important
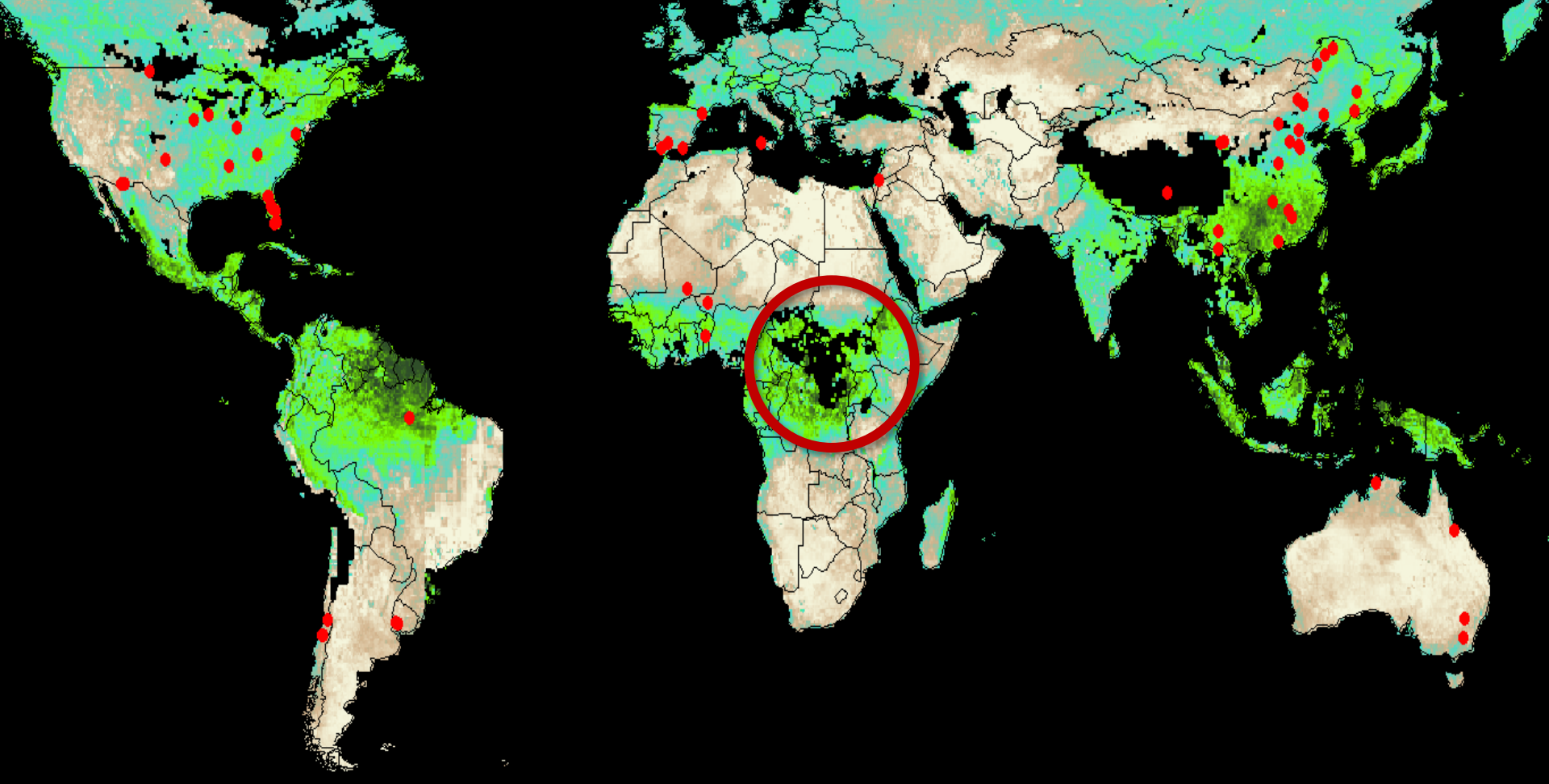
GLOBAL ET MAPPING with Alexi
… cloud gapfilling with Ka-band LST

Compatability with UAS/Aerial/SmallSat

- ◈ Infrequent satellite revisits in clouded areas can be benefited
  - ▪ by UAS/Aerial if affordable and planned ahead.
  - ▪ by SmallSat if frequent enough. A vegetation-based estimate needs to be used.
- ◈ Higher resolution from all systems can help 'inform' and train satellite based systems and to better understand the science